25 Years of Research Excellence 1977-2002

National Renewable Energy Laboratory

An Introduction to HOMER

Hybrid Optimization Model for Electric Renewables

September 24, 2002
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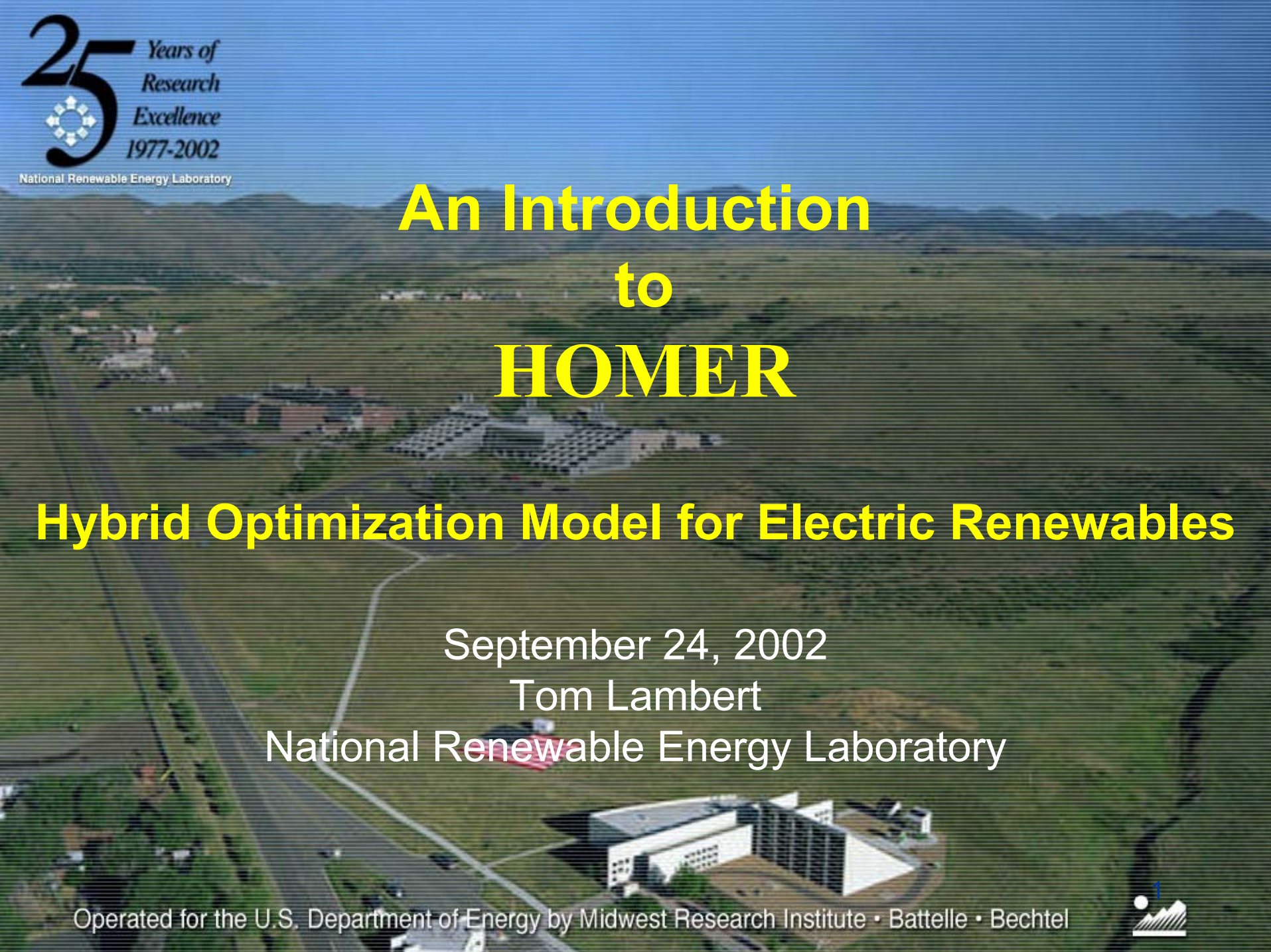


What is HOMER?

A tool for designing hybrid power systems comprising:

- wind turbines

- PV

- batteries
- diesels

- microturbines

- fuel cells

- small hydro

- small modular biomass

- grid connection

What is HOMER?

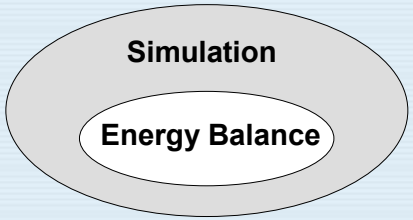
Key HOMER concepts:

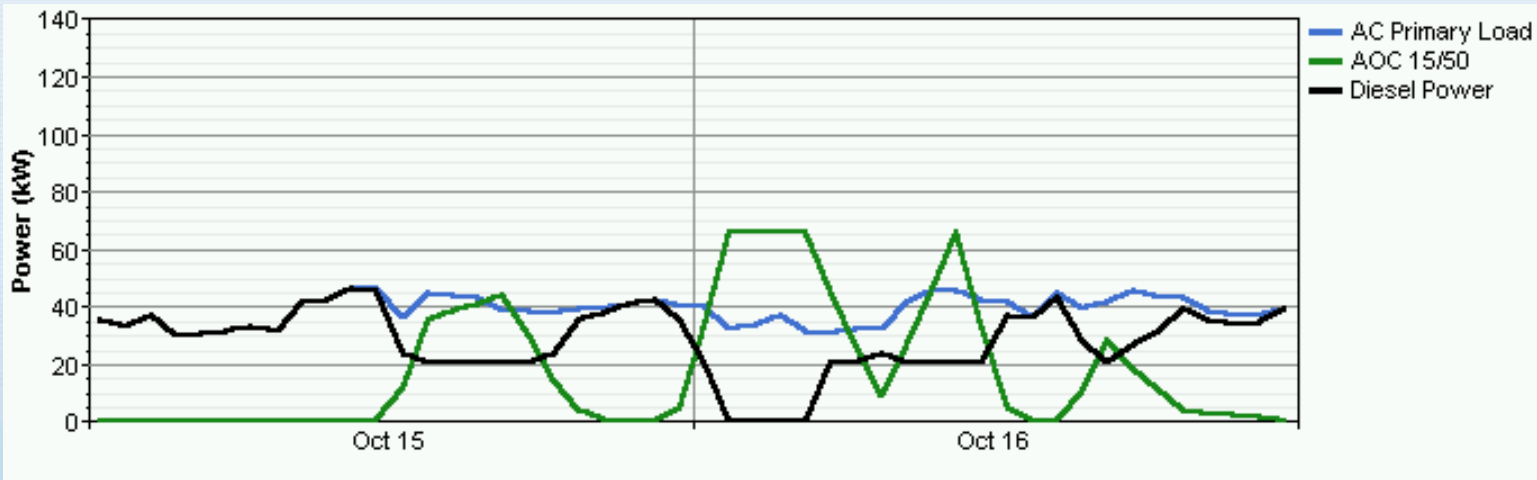
- ***hourly energy balance***:
  - compare the energy supply and demand in a single hour
  - decide how to operate dispatchable sources (generators, batteries, grid)

What is HOMER?

Key HOMER concepts:

- ***simulation***: performing an energy balance for each hour of the year to determine feasibility and costs

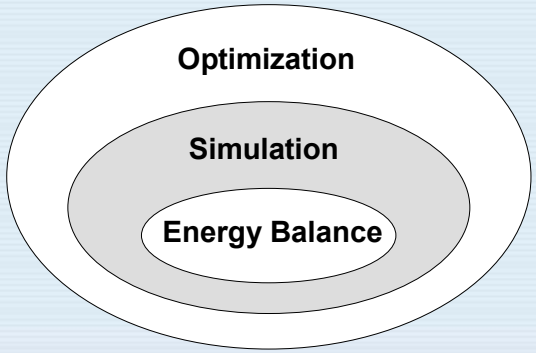




What is HOMER?

Key HOMER concepts:

- ***optimization***: the process of finding the least-cost configuration of a hybrid power system



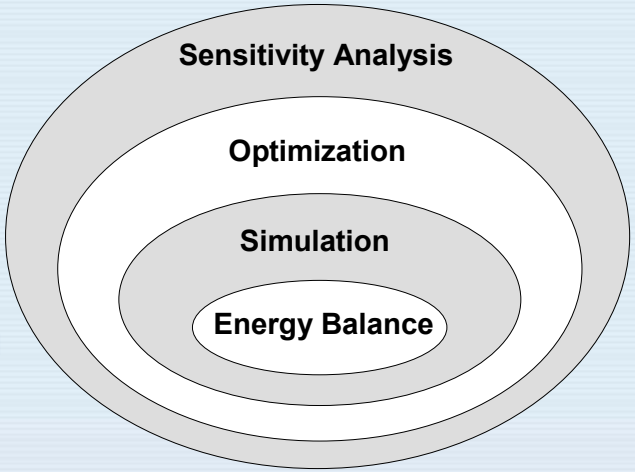
System Designs | Graphic Display

Double click on a system below for details. ○ Categorized ◉ Overall Export

	WT 1	Dsl (kW)	Total Capital	Total NPC	COE ($/kWh)	Ren. Frac.	Unsrv. Frac.	Excess Frac.	Diesel (L)	Dsl (hrs)
	2	70	$ 242,400	$ 1,200,212	0.263	0.37	0.00	0.34	71,084	6455
	3	70	$ 352,400	$ 1,242,420	0.272	0.43	0.00	0.47	63,672	5731
	1	70	$ 132,400	$ 1,279,849	0.281	0.23	0.00	0.17	87,654	8076
		70	$ 22,400	$ 1,308,659	0.287	0.00	0.00	0.00	106,8...	8760

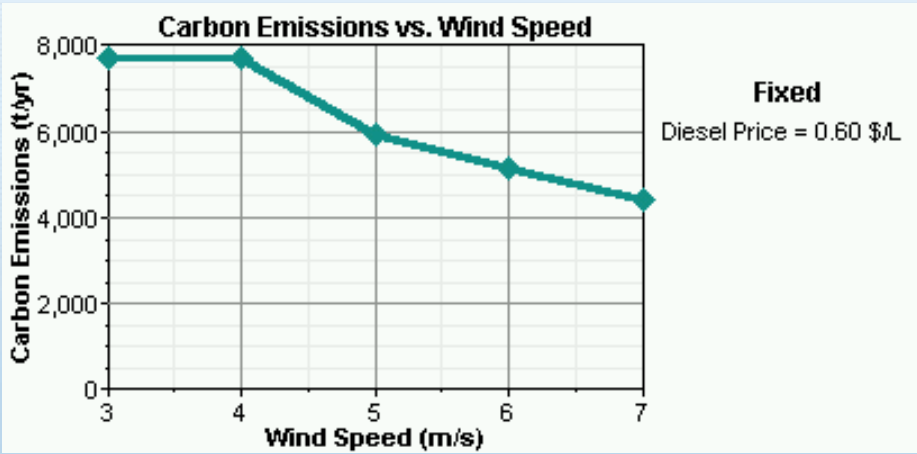
What is HOMER?

Key HOMER concepts:



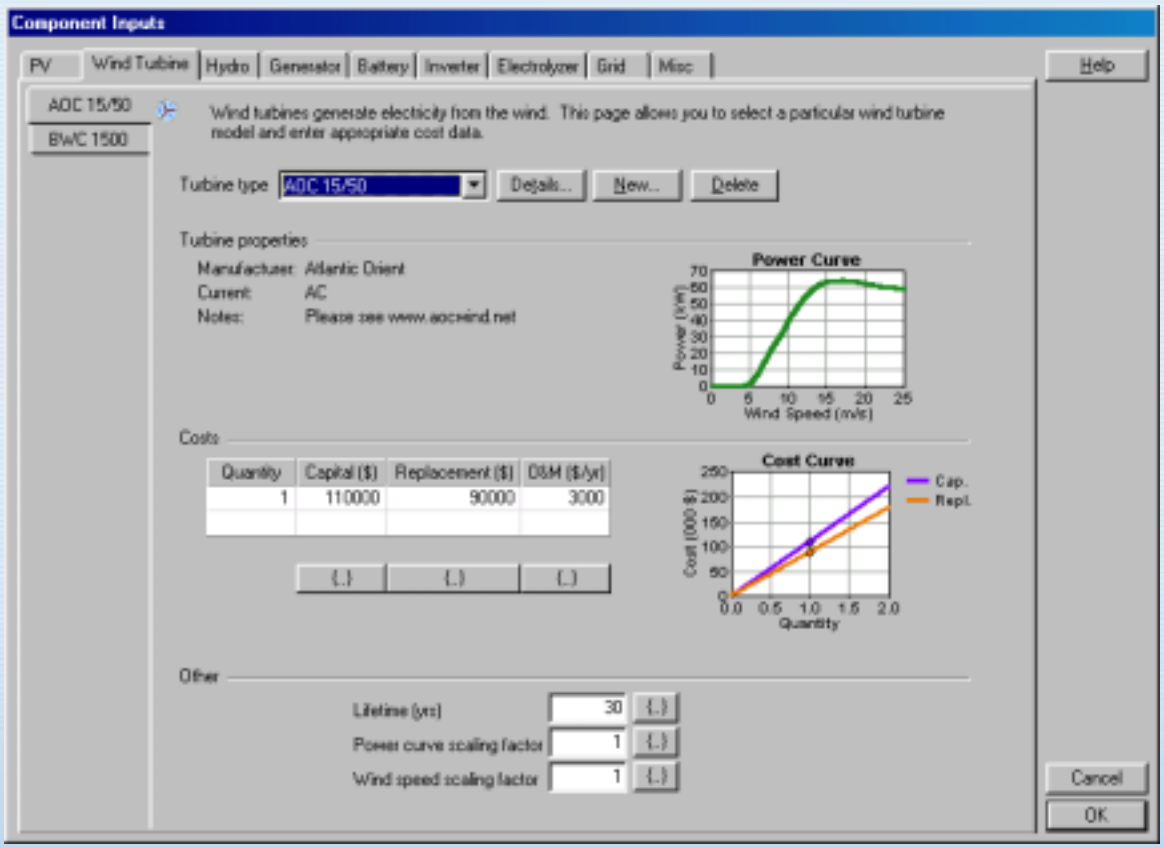
- ***sensitivity analysis***: a method of examining the effects of variation in external factors

  (e.g., fuel price, wind speed, interest rate)



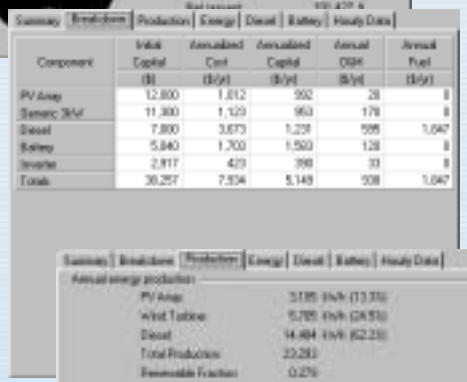
What does HOMER look like?

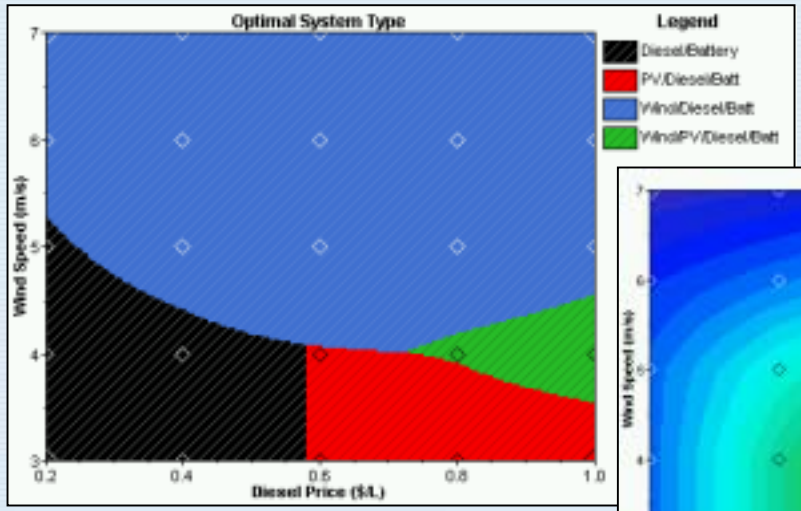
Simple input screens

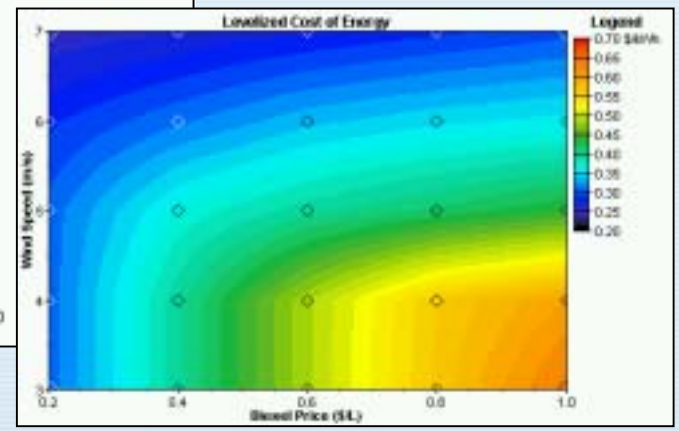


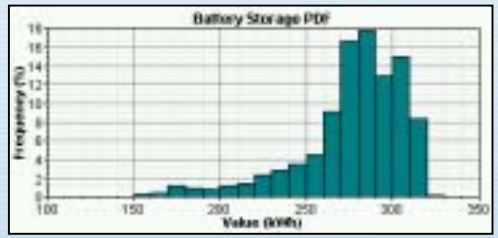
What does HOMER look like?

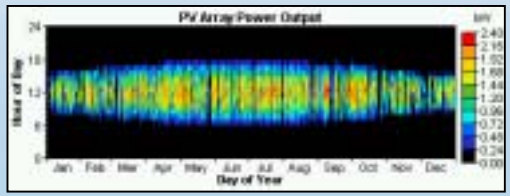
Tabular and graphic outputs

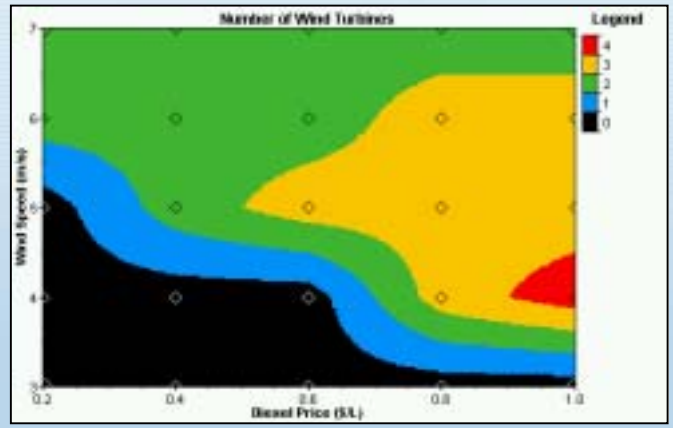






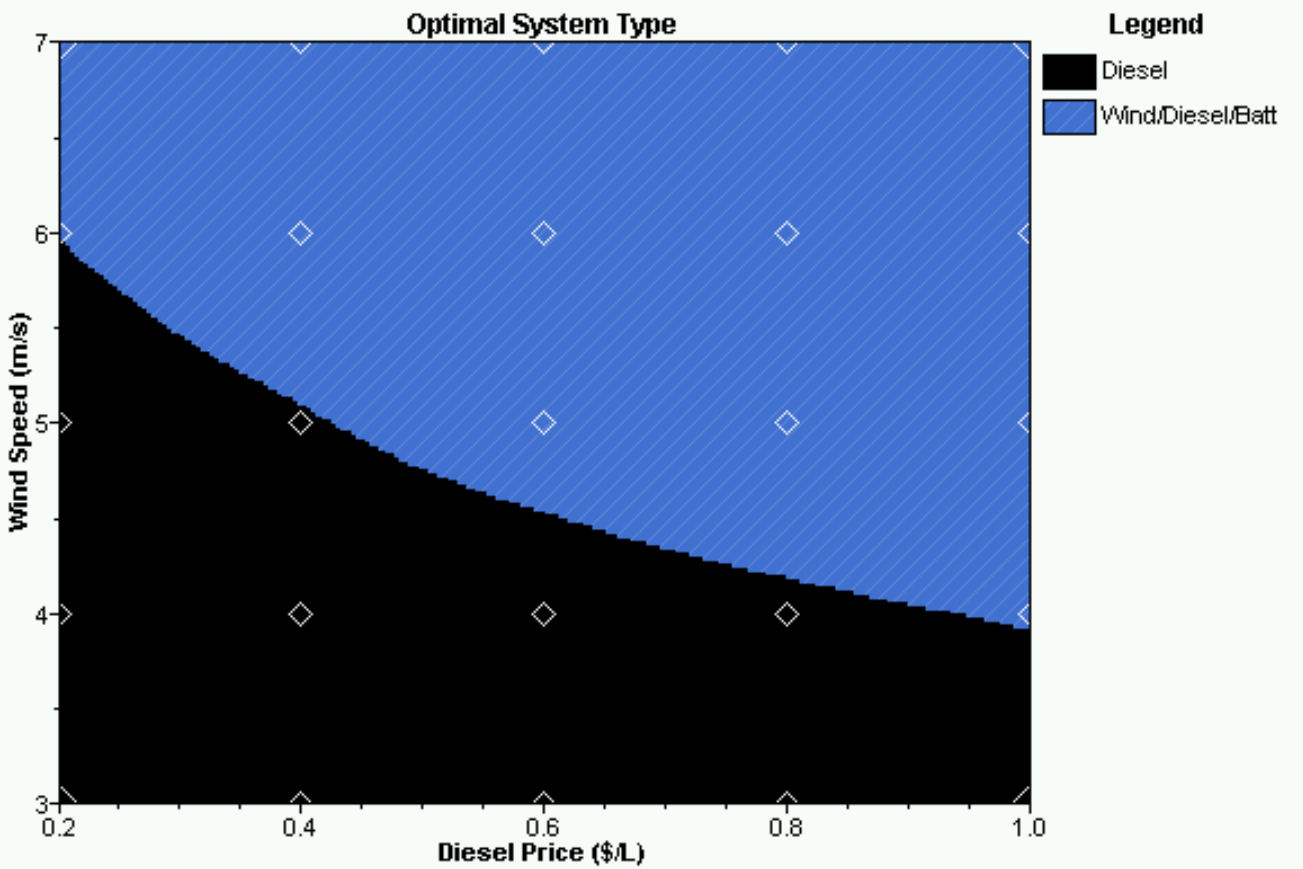






What can HOMER do?

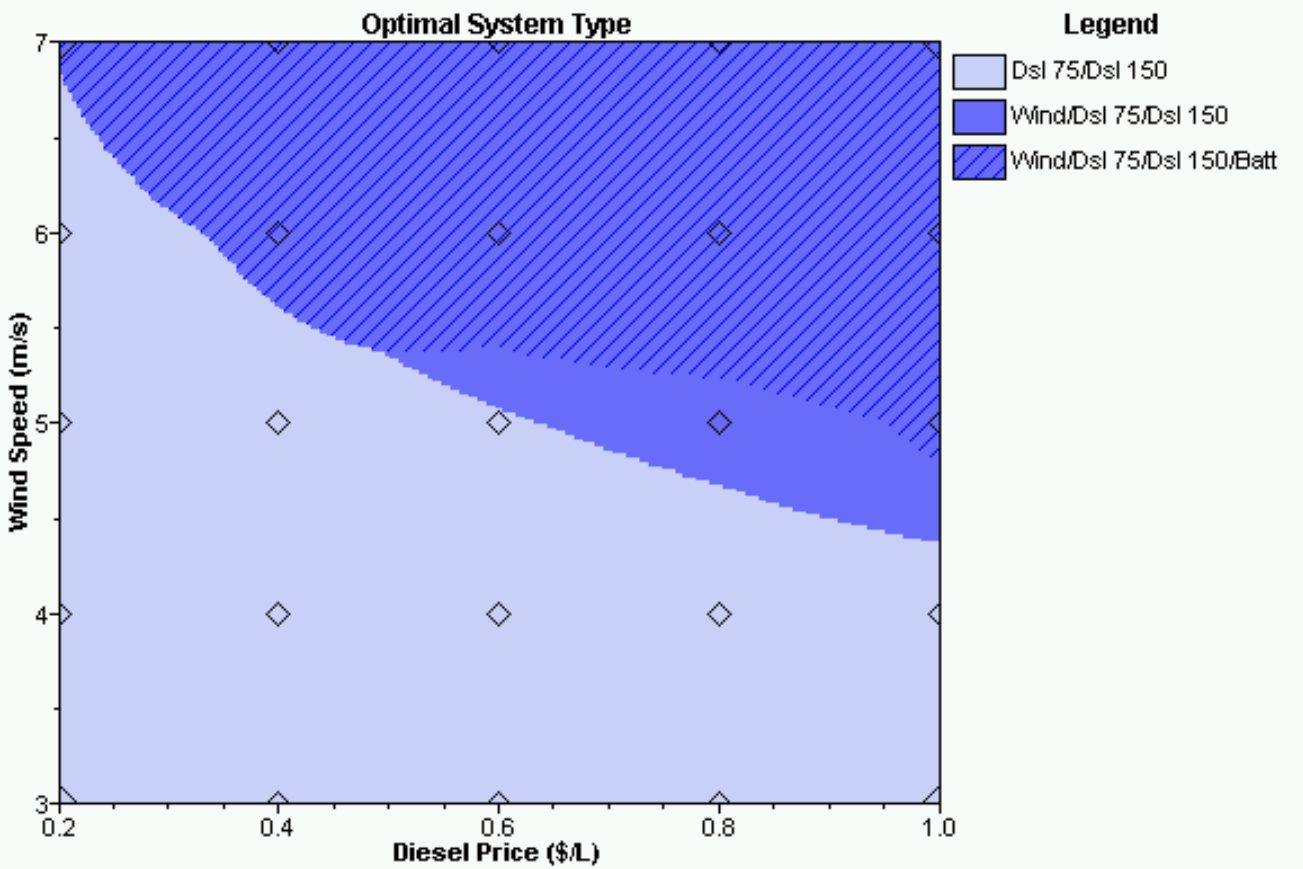
When does wind compete with diesel?



(63 kW peak load, 33 kW average load, 70 kW diesel, 50 kW wind turbine)

What can HOMER do?

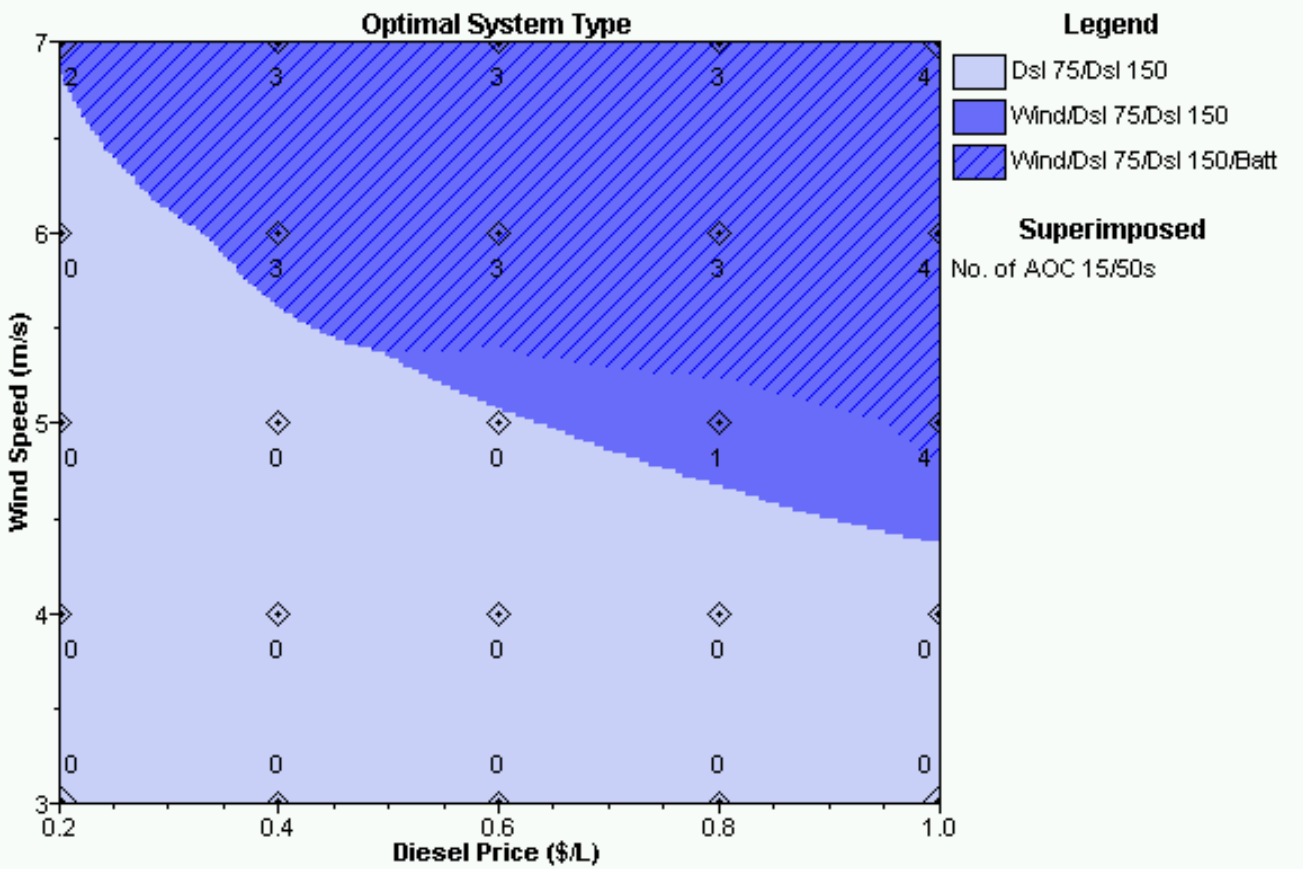
When does wind compete with two diesels?



(130 kW peak load, 65 kW average load, 75 and 100 kW diesels, 50 kW wind turbine)

What can HOMER do?

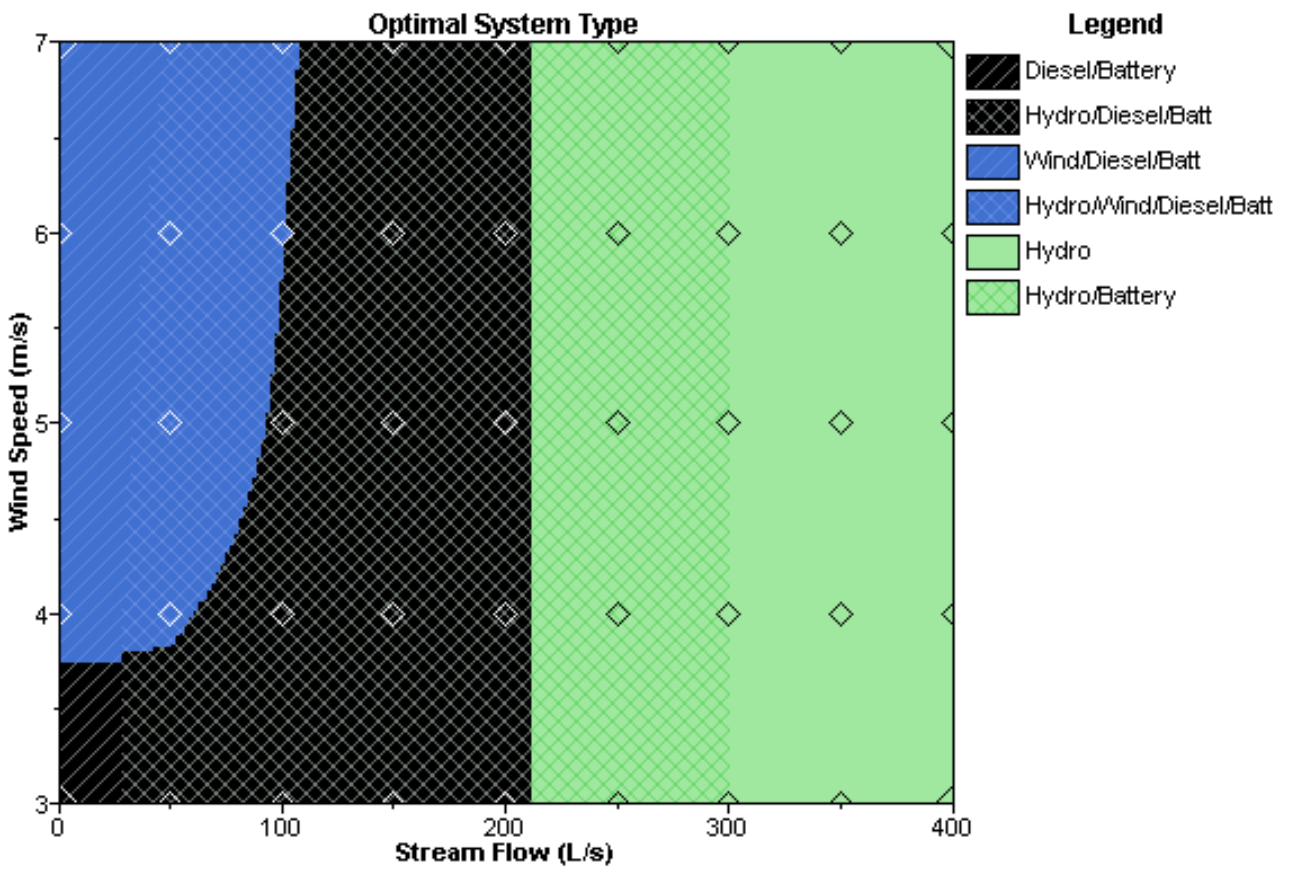
When does wind compete with two diesels?



(130 kW peak load, 65 kW average load, 75 and 100 kW diesels, 50 kW wind turbine)

What can HOMER do?

Do hydro/wind systems make sense?



(48 kW peak load, 17 kW average load, 60 kW diesel, 50 kW wind turbine)

HOMER and Hybrid2

HOMER and Hybrid2: what's the difference?

- **HOMER:** rapid simulation, optimization, what-if analyses

- **Hybrid2:** more detailed and accurate simulation

How do I get HOMER?

http://www.nrel.gov/international/homer/

How do I find out more?

Email:

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tom_lambert@nrel.gov